

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark
Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 01 July 1999 (01.07.99)	
International application No. PCT/US98/23625	Applicant's or agent's file reference 0698.086/PCT
International filing date (day/month/year) 06 November 1998 (06.11.98)	Priority date (day/month/year) 07 November 1997 (07.11.97)
Applicant ALPEROVICH, Mark et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

07 June 1999 (07.06.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p style="text-align: center;">The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p style="text-align: center;">Nicola Wolff</p> <p>Telephone No.: (41-22) 338.83.38</p>
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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF RECEIPT OF RECORD COPY

(PCT Rule 24.2(a))

From the INTERNATIONAL BUREAU

To:

COHEN, Herbert
Blank Rome Comisky & McCauley LLP
Wigman, Cohen, Leitner & Myers
Intellectual Property Group
900 17th Street, N.W.
Washington, DC 20006
ÉTATS-UNIS D'AMÉRIQUE

Date of mailing (day/month/year) 23 December 1998 (23.12.98)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 0698.086/PCT	International application No. PCT/US98/23625

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

OMD DEVICES LLC (for all designated States except US)
ALPEROVICH, Mark et al (for US)

International filing date : 06 November 1998 (06.11.98)
Priority date(s) claimed : 07 November 1997 (07.11.97)
Date of receipt of the record copy
by the International Bureau : 14 December 1998 (14.12.98)
List of designated Offices :

AP : GH, GM, KE, LS, MW, SD, SZ, UG, ZW
EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM
EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE
OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG
National : AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM,
HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL,
PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW

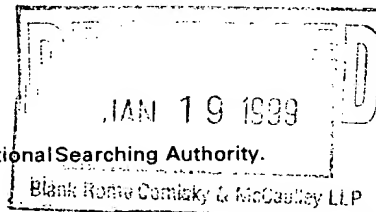
ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- ☒ time limits for entry into the national phase
- ☒ confirmation of precautionary designations
- ☒ requirements regarding priority documents

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.



The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer: B. Fitzgerald Telephone No. (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

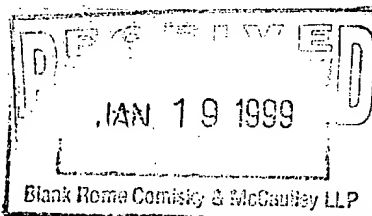
COHEN, Herbert
Blank Rome Comisky & McCauley LLP
Wigman, Cohen, Leitner & Myers
Intellectual Property Group
900 17th Street, N.W.
Washington, DC 20006
ÉTATS-UNIS D'AMÉRIQUE

Date of mailing (day/month/year) 06 January 1999 (06.01.99)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 0698.086/PCT	
International application No. PCT/US98/23625	International filing date (day/month/year) 06 November 1998 (06.11.98)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 07 November 1997 (07.11.97)
Applicant OMD DEVICES LLC et al	

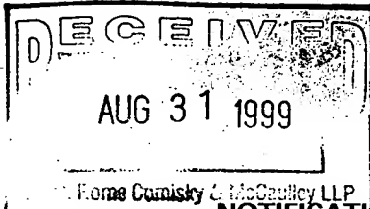
- The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
- This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
- An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed to Rule 17.1(c)** which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
- The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed to Rule 17.1(c)** which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
07 Nove 1997 (07.11.97)	60/064,388	US	15 Dece 1998 (15.12.98)

DOCKETED NK ATTORNEY DJE
CASE 0698.086
DATE Chap II Amend 6-17-99



The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer Carlos Naranjo Telephone No. (41-22) 338.83.38
--	---



PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

COHEN, Herbert
Blank Rome Comisky & McCauley LLP
Wigman, Cohen, Leitner & Myers
Intellectual Property Group
900 17th Street, N.W.
Washington, DC 20006
ÉTATS-UNIS D'AMÉRIQUEDate of mailing (day/month/year)
16 August 1999 (16.08.99)Applicant's or agent's file reference
0698.086/PCTInternational application No.
PCT/US98/23625 ✓

IMPORTANT NOTIFICATION

International filing date (day/month/year)
06 November 1998 (06.11.98)

1. The following indications appeared on record concerning:

☒ the applicant ☒ the inventor ☐ the agent ☐ the common representative

Name and Address

KRUPKIN, Vladimir
Ashdod
Israel

State of Nationality

IL

State of Residence

IL

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☐ the name ☒ the address ☐ the nationality ☐ the residence

Name and Address

KRUPKIN, Vladimir
5/27 Rueven & Batsheva Street
75357 Rishon le-Zion
Israel

State of Nationality

IL

State of Residence

IL

Telephone No.

Facsimile No.

Teleprinter No.

DOCKETED

000698.0086

AUG 31 1999

JH

Action Due

Due Date

noted

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

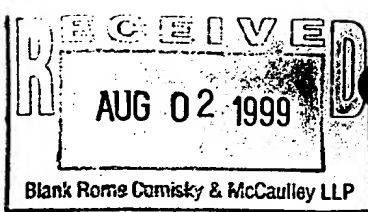
☒ the receiving Office ☐ the designated Offices concerned
☐ the International Searching Authority ☒ the elected Offices concerned
☒ the International Preliminary Examining Authority ☐ other:The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Ingrid Aulich

Telephone No.: (41-22) 338.83.38



PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

COHEN, Herbert
Blank Rome Comisky & McCauley LLP
Wigman, Cohen, Leitner & Myers
Intellectual Property Group
900 17th Street, N.W.
Washington, DC 20006
ÉTATS-UNIS D'AMÉRIQUEDate of mailing (day/month/year)
27 July 1999 (27.07.99)Applicant's or agent's file reference
0698.086/PCTInternational application No.
PCT/US98/23625 ✓

IMPORTANT NOTIFICATION

International filing date (day/month/year)
06 November 1998 (06.11.98)

1. The following indications appeared on record concerning:

☒ the applicant ☒ the inventor ☐ the agent ☐ the common representative

Name and Address

SUL, Irene
Ashdod
Israel

State of Nationality

IL

State of Residence

IL

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☒ the name ☒ the address ☐ the nationality ☐ the residence

Name and Address

ZUHL, Irene
10/3 Yoav Ben Tzruya Street
77535 Ashdod
Israel

State of Nationality

IL

State of Residence

IL

Telephone No.

Facsimile No.

Teleprinter No.

Action Due

Due Date

DOCKETED
00698.0086
AUG 02 1999
POC

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

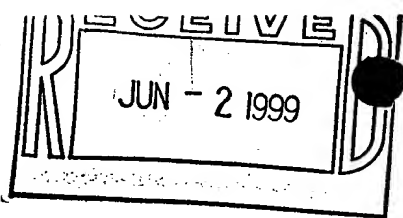
☒ the receiving Office ☐ the designated Offices concerned
☐ the International Searching Authority ☒ the elected Offices concerned
☒ the International Preliminary Examining Authority ☐ other:The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Ting Zhao

Telephone No.: (41-22) 338.83.38



PATENT COOPERATION TREATY

HC

PCT

From the INTERNATIONAL BUREAU

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

COHEN, Herbert
Blank Rome Comisky & McCauley LLP
Wigman, Cohen, Leitner & Sawyer
Intellectual Property Group
900 17th Street, N.W.
Washington, DC 20006
ÉTATS-UNIS D'AMÉRIQUE

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JUN 4 1999

mc

Action DueDue Date

Date of mailing (day/month/year) 20 May 1999 (20.05.99)		IMPORTANT NOTICE	
Applicant's or agent's file reference 0698.086/PCT			
International application No. PCT/US98/23625 ✓	International filing date (day/month/year) 06 November 1998 (06.11.98)	Priority date (day/month/year) - 07 November 1997 (07.11.97)	
Applicant OMD DEVICES LLC et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU,CN,EP,IL,JP,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CU,CZ,DE,DK,EA,EE,ES,FI,GB,GE,GH,GM,HR,HU,ID,
IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,
SI,SK,SL,TJ,TM,TR,TT,UA,UG,UZ,VN,YU,ZW
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).
3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
20 May 1999 (20.05.99) under No. WO 99/24527

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer J. Zahra Telephone No: (41-22) 338.83.38
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MC

From the INTERNATIONAL BUREAU

PCT

INFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

To:

COHEN, Herbert
Blank Rome Comisky & McCauley LLP
Wigman, Cohen, Leitner & Myers
Intellectual Property Group
900 17th Street, N.W.
Washington, DC 20006
ÉTATS-UNIS D'AMÉRIQUE

Date of mailing (day/month/year) 01 July 1999 (01.07.99)		IMPORTANT INFORMATION	
Applicant's or agent's file reference 0698.086/PCT			
International application No. PCT/US98/23625	International filing date (day/month/year) 06 November 1998 (06.11.98)	Priority date (day/month/year) 07 November 1997 (07.11.97)	
Applicant OMD DEVICES LLC et al			

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP : GH, GM, KE, LS, MW, SD, SZ, UG, ZW

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

National : AU, BG, BR, CA, CN, CZ, DE, GB, IL, JP, KP, KR, MN, NO, NZ, PL, RO, RU, SE, SK, US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG

National : AL, AM, AT, AZ, BA, BB, BY, CH, CU, DK, EE, ES, FI, GE, GH, GM, HR, HU, ID, IS, KE,
KG, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MW, MX, PT, SD, SG, SI, SL, TJ, TM, TR, TT, UA,
UG, UZ, VN, YU, ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

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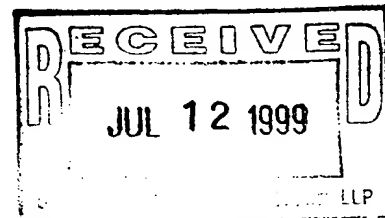
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JUL 12 1999

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Action Due

Due Date

ms



The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer: <i>N. Wolff</i> Nicola Wolff Telephone No. (41-22) 338.83.38
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PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

JUN 23 1999

PCT

Blank Rome Cemetery & McCauley LLP

To:
HERBERT COHEN
BLANK ROME COMISKY & MCCAULEY LLP
WIGMAN, COHEN, LEITNER & MYERS
900 17TH STREET, N.W.
WASHINGTON, DC, DC 20006

NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(e) and 61.1(b), first sentence
and Administrative Instructions, Section 601(a))

Date of mailing
(day/month/year)

17 JUN 1999

Applicant's or agent's file reference
0698.086/PCT

IMPORTANT NOTIFICATION

International application No.
PCT/US98/23625 ✓

International filing date (day/month/year)
06 NOV 98

Priority date (day/month/year)
07 NOV 97

Applicant
OMD DEVICES LLC

1. The applicant is hereby **notified** that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

07 JUNE 1999 (07.06.99)

2. That date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
- ☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
- ☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is **AFTER** the expiration of 19 months from the priority date. Consequently, the election(s) made in the demand does (do) not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22). For details, see the *PCT Applicant's Guide*, Volume II.

- ☐ (If applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/
Assistant Commissioner for Patent
Box PCT
Washington, D.C. 20231 Attn:RO/US
Facsimile No. 703-305-3230

Authorized officer Barbara Fridie
PCT Operations - IAPD Team 1
(703) 305-3747 (703) 305-3230 (FAX)

Telephone No.

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

WRITTEN OPINION

(PCT Rule 66)

To: HERBERT COHEN BLANK ROME COMISKY & MCCAULEY LLP WIGMAN, COHEN, LEITNER & MYERS 900 17TH STREET, N.W. WASHINGTON, DC 20006
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JUL 20 1999

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Action Due	Due Date
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Date of Mailing (day/month/year)	14 JUL 1999
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Applicant's or agent's file reference 0698.086/PCT	REPLY DUE within TWO months from the above date of mailing
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International application No. PCT/US98/23625	International filing date (day/month/year) 06 NOVEMBER 1998	Priority date (day/month/year) 07 NOVEMBER 1997
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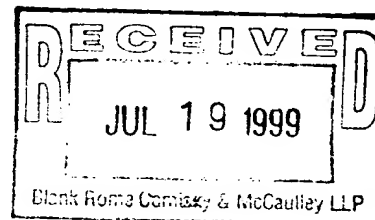
International Patent Classification (IPC) or both national classification and IPC Please See Supplemental Sheet.

Applicant OMD DEVICES LLC

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application



3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. ~~The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).~~

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
 For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
 For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 07 MARCH 2000

Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer C. MELISSA KOSLOW <i>[Signature]</i>
Facsimile No. (703) 305-3230	Telephone No. (703) 308-0661

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. STATEMENT**

Novelty (N)	Claims	<u>1-26</u>	YES
	Claims	<u>NONE</u>	NO
Inventive Step (IS)	Claims	<u>1-11 and 15-21</u>	YES
	Claims	<u>12-14 and 22-26</u>	NO
Industrial Applicability (IA)	Claims	<u>1-26</u>	YES
	Claims	<u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-11 and 15-21 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a fluorescent composition comprising at least one fluorescent dye, at least one film forming polymer, a plasticizer and an organic solvent. The prior art also does not teach or fairly suggest the claimed method for producing multilayered CD-ROM optical disks where the information is recorded using a fluorescent composition.

Claims 12-14 and 22-26 meet the criteria set out in PCT Article 33(4), because the claimed process and CD-ROM have industrial applicability.

Claims 12-14 and 22-26 lack an inventive step under PCT Article 33(3) as being obvious over Chikuma.

This reference teaches a CD-ROM optical disk having a fluorescent composition in the pits. This suggests a method for manufacturing a CD-ROM optical disk by providing a substrate which is formed as a disk which has a surface and the surface is covered with pits and then applying a fluorescent composition using any conventional method, which includes spin coating, roller coating or dip coating, to the surface of the substrate so as to fill the pits with the fluorescent composition and the surface outside the pits remains free of the fluorescent compound. While the depth of the pits are not taught, the reference implies they should be of a conventional depth. The specification implies the claimed pit depth is within the conventional range and thus the claimed range is suggested.

While the reference does not teach the composition of fluorescent composition, one of ordinary skill in the art would have found it obvious to use any convention fluorescent composition of a fluorescent dye in a film forming resin that the transparent to the light wavelengths used to excite the dye and to the light wavelengths emitted by the dye. These compositions usually also contain a plasticizer and surfactant to improve the workability of the composition and a light stabilizer if the resin is (Continued on Supplemental Sheet.)

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation f: Boxes I - VIII

Sheet 10

TIME LIMIT:

The time limit set for response to a Written Opinion may not be extended. 37 CFR 1.484(d). Any response received after the expiration of the time limit set in the Written Opinion will not be considered in preparing the International Preliminary Examination Report.

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:
IPC(6): C09K 11/06; G11B 3/70, 7/24 and US Cl.: 252/301.35, 301.34; 427/157; 396/288, 283, 275.4, 101; 420/270.14, 270.15, 270.18, 270.19, 270.2, 270.21

V. 2. REASONED STATEMENTS - CITATIONS AND EXPLANATIONS (Continued):

degraded by either the emitted or exciting wavelengths. The claimed polymers are conventionally used as the resin in fluorescent compositions. Thus the claimed process and CD-ROM are suggested by the art.

____ NEW CITATIONS ____

NONE

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To: HERBERT COHEN
BLANK ROME COMISKY & MCCAULEY LLP
WIGMAN, COHEN, LEITNER & MYERS
900 17TH STREET, N. W.
WASHINGTON, DC 20006

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing
(day/month/year)

06 APR 2000

Applicant's or agent's file reference
0698.086/PCT

IMPORTANT NOTIFICATION

International application No.
PCT/US98/23625

International filing date (day/month/year)
06 NOVEMBER 1998

Priority Date (day/month/year)
07 NOVEMBER 1997

Applicant
OMD DEVICES LLC

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/2001).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

C. MELISSA KOSLOW

Telephone No. (703) 308-0661

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

17

Applicant's or agent's file reference 0698.086/PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US98/23625	International filing date (day/month/year) 06 NOVEMBER 1998	Priority date (day/month/year) 07 NOVEMBER 1997
International Patent Classification (IPC) or national classification and IPC Please See Supplemental Sheet.		
Applicant OMD DEVICES LLC		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets.


☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 22 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☒ Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

**CORRECTED
VERSION**

Date of submission of the demand 07 JUNE 1999	Date of completion of this report 18 JANUARY 2000
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer C. MELISSA KOSLOW 
Facsimile No. (703) 305-3230	Telephone No. (703) 308-0661

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/23625

I. Basis of the report

1. This report has been drawn on the basis of *(Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain*

☐ the international application as originally filed.

☒ the description, pages (See Attached) , as originally filed.

pages _____ , filed with the demand.

pages _____ , filed with the letter of _____.

pages _____ , filed with the letter of _____.

☒ the claims, Nos. (See Attached) , as originally filed.

Nos. _____ , as amended under Article 19.

Nos. _____ , filed with the demand.

Nos. _____ , filed with the letter of _____.

Nos. _____ , filed with the letter of _____.

☒ the drawings, sheets/~~fig~~ (See Attached) , as originally filed.

sheets/~~fig~~ _____ , filed with the demand.

sheets/~~fig~~ _____ , filed with the letter of _____.

sheets/~~fig~~ _____ , filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☒ the description, pages NONE.

☒ the claims, Nos. NONE.

☒ the drawings, sheets/~~fig~~ NONE.

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the ~~Supplemental Box~~ Additional observations below (Rule 70.2(c)).

4. Additional observations, if necessary:

NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US98/23625

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The question whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been and will not be examined in respect of:

☐ the entire international application.

☒ claims Nos. 4 and 5

because:

☐ the said international application, or the said claim Nos. _ relate to the following subject matter which does not require international preliminary examination (*specify*).

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 4 and 5 are so unclear that no meaningful opinion could be formed (*specify*).

These claims are improperly multiple dependent claims since they depend from other multiple dependent claims. PCT Rule 6.4(a).

☐ the claims, or said claims Nos. _ are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for said claims Nos. _.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/23625

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. STATEMENT**

Novelty (N)	Claims <u>1-3 and 6-26</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>1-3 and 6-21</u>	YES
	Claims <u>NONE</u>	NO
Industrial Applicability (IA)	Claims <u>1-3 and 6-26</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-3 and 6-26 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a fluorescent composition comprising at least one fluorescent dye, at least one film forming polymer, a plasticizer and an organic solvent nor a CD-ROM optical disk containing this composition. The prior art also does not teach or fairly suggest the claimed method for producing CD-ROM optical disks where the information is recorded using a fluorescent composition.

----- NEW CITATIONS -----
NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/23625

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claim 15 objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof: This claim, which is directed to method, depends from claim 10, which is a composition claim, not a method claim.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/23625

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:

IPC(7): C09K 11/06; G11B 3/70, 7/24 and US Cl.: 252/301.35, 301.34; 427/157; 396/288, 283, 275.4, 101; 420/270.14, 270.15, 270.18, 270.19, 270.2, 270.21

I. BASIS OF REPORT:

This report has been drawn on the basis of the description,

pages, NONE, as originally filed.

pages, NONE, filed with the demand.

and additional amendments:

Pages 1-19, filed with the letter of 14 September 1999

This report has been drawn on the basis of the claims,

numbers, NONE, as originally filed.

numbers, NONE, as amended under Article 19.

numbers, NONE, filed with the demand.

and additional amendments:

Claims 1-26, filed with the letter of 14 September 1999

This report has been drawn on the basis of the drawings,

sheets, 1, as originally filed.

sheets, NONE, filed with the demand.

and additional amendments:

NONE

PATENT COOPERATION TREATY

PCT

REC'D 17 FEB 2000

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

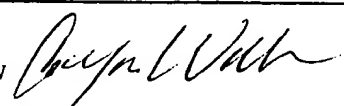
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 0698.086/PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US98/23625	International filing date (day/month/year) 06 NOVEMBER 1998	Priority date (day/month/year) 07 NOVEMBER 1997
International Patent Classification (IPC) or national classification and IPC Please See Supplemental Sheet.		
Applicant OMD DEVICES LLC		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets.
- ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of — sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 07 JUNE 1999	Date of completion of this report 18 JANUARY 2000
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer C. MELISSA KOSLOW 
Facsimile No. (703) 305-3230	Telephone No. (703) 308-0661

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/23625

I. Basis of the report

1. This report has been drawn on the basis of *(Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments).*

☒ the international application as originally filed.

☒ the description, pages 1-19 , as originally filed.

pages NONE , filed with the demand.

pages NONE , filed with the letter of _____.

pages _____ , filed with the letter of _____.

☒ the claims, Nos. 1-26 , as originally filed.

Nos. NONE , as amended under Article 19.

Nos. NONE , filed with the demand.

Nos. NONE , filed with the letter of _____.

Nos. _____ , filed with the letter of _____.

☒ the drawings, sheets/fig 1 , as originally filed.

sheets/fig NONE , filed with the demand.

sheets/fig NONE , filed with the letter of _____.

sheets/fig _____ , filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☒ the description, pages NONE .

☒ the claims, Nos. NONE .

☒ the drawings, sheets/fig NONE .

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the ~~Supplemental Box~~ Additional observations below (Rule 70.2(c)).

4. Additional observations, if necessary:

NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/23625

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. STATEMENT**

Novelty (N)	Claims <u>1-26</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>1-11 and 15-21</u>	YES
	Claims <u>12-14 and 22-26</u>	NO
Industrial Applicability (IA)	Claims <u>1-26</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-11 and 15-21 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a fluorescent composition comprising at least one fluorescent dye, at least one film forming polymer, a plasticizer and an organic solvent. The prior art also does not teach or fairly suggest the claimed method for producing multilayered CD-ROM optical disks where the information is recorded using a fluorescent composition.

Claims 12-14 and 22-26 meet the criteria set out in PCT Article 33(4), because the claimed process and CD-ROM have industrial applicability.

Claims 12-14 and 22-26 lack an inventive step under PCT Article 33(3) as being obvious over Chikuma.

This reference teaches a CD-ROM optical disk having a fluorescent composition in the pits. This suggests a method for manufacturing a CD-ROM optical disk by providing a substrate which is formed as a disk which has a surface and the surface is covered with pits and then applying a fluorescent composition using any conventional method, which includes spin coating, roller coating or dip coating, to the surface of the substrate so as to fill the pits with the fluorescent composition and the surface outside the pits remains free of the fluorescent compound. While the depth of the pits are not taught, the reference implies they should be of a conventional depth. The specification implies the claimed pit depth is within the conventional range and thus the claimed range is suggested.

While the reference does not teach the composition of fluorescent composition, one of ordinary skill in the art would have found it obvious to use any convention fluorescent composition of a fluorescent dye in a film forming resin that the transparent to the light wavelengths used to excite the dye and to the light wavelengths emitted by the dye. These compositions usually also contain a plasticizer and surfactant to improve the workability of the composition and a light stabilizer if the resin is (Continued on Supplemental Sheet.)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/23625

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:

IPC(7): C09K 11/06; G11B 3/70, 7/24 and US Cl.: 252/301.35, 301.34; 427/157; 396/288, 283, 275.4, 101; 420/270.14, 270.15, 270.18, 270.19, 270.2, 270.21

V. 2. REASONED STATEMENTS - CITATIONS AND EXPLANATIONS (Continued):

degraded by either the emitted or exciting wavelengths. The claimed polymers are conventionally used as the resin in fluorescent compositions. Thus the claimed process and CD-ROM are suggested by the art.

----- NEW CITATIONS -----

NONE

REPLACED BY
ART 34 AMDE

WO 99/24527

09/530114

PCT/US98/23625

416 Rec'd PCT/PTO 25 APR 2000

FLUORESCENT COMPOSITION FOR THE MANUFACTURE OF CD-

ROM TYPE OPTICAL MEMORY DISKS

FIELD OF THE INVENTION

5 This invention relates generally to optical materials for, and to a method of, forming optical memory discs of the CD-ROM type for use with fluorescent reading, including disks for three-dimensional (3D) optical memory systems.

BACKGROUND OF THE INVENTION

To date, digital information carriers for recording, storing, and reading sound and
10 images by optical methods have received wide recognition.

Generally, information is written in the form of local changes to the active medium optical thickness or the reflection coefficient, while reading is performed using laser emission and is based on the laser beam phase or amplitude changes in information record centers.

CD-ROM's are the least expensive and most sophisticated of the optical information
15 carriers. However, both the storage volume and the signal-to-noise ratio of currently used CD-ROM's are inadequate for the new generations of computers and video systems now under development.

Therefore, materials for better optical memory systems are being actively developed. These materials are required to provide an increased data density, a high signal-to-noise ratio,
20 an improved operation and storing stability, and low costs.

A promising approach to the increase of optical information carrier capacity consists of

- increasing the number of information bits per active layer by shortening the pits and increasing their amount, and
- producing multilayer disks.

This approach is implemented in the DVD standard disks that have recently appeared
5 on the market. In these disks, the pit size is halved and the number of active layers is increased to 4, two on each side of the substrate. This has enabled the disk capacity to be increased up to 20 GB.

However, when reflection coefficient changes are used for reading, further increase of the number of disk active layers results in a sharp cost increase of the system and
10 deterioration of data retrieval quality. As a result, attempts to increase the disk capacity fail.

Known in the prior art are Japanese patent publications [JP 63-195,838 (August 12, 1988); JP 02-308,439 (December 21, 1990)] suggesting a fluorescent reading method. The concept of this method is that after the writing process the information record centers do not fluoresce, whereas the background does. When reading with a corresponding laser beam, the
15 fluorescent light is excited and registered with a detector.

The above references suggest laser beam recorded optical disks which are of the WORM (write once, read many) type and thus cannot be used as CD-ROM type disks. Additionally, the optical disks proposed in the first of the above references are so constructed that the active layer is deposited on a dull substrate surface. This technology prevents the
20 production of multilayer disks, because light excited on reading is subject to strong scattering.

Materials based on photochromic compounds, preferably spirobenzopyrans, contained in a polymer matrix, were suggested by D.A. Pathenopulos, and R.M. Rentzepis, *Science*, 245, 843 (1989); and R.M. Rentzepis, US Patent 5,268,862 (December 7, 1993) to be used as

3D optical memory medium where multilayer data writing and fluorescent reading are performed. With these materials, information is written by the two-photon excitation of the initial non-fluorescing form A of the photochromic compound, this excitation being produced by two focused laser beams intersecting in definite locations of active medium.

5 Under excitation, form A transforms to form B. Form B absorbs two reading emission photons and emits the fluorescent light which is absorbed by a detector. Materials of this type are intended for repeatedly rewritten memory, because heating or irradiation results in erasing data due to the transformation of form B to initial form A.

A practical implementation of 3D optical memory concepts and methods, as suggested
10 by US Patent No. 5,268,862, is quite problematic and highly improbable for a number of reasons, including, in particular, the following:

1. A low photochemical and thermal stability of suggested photochromic compounds resulting in their destruction after repeated writing – reading – erasing cycles.

2. The possibility of erasing data (form B to form A transition) in the process of
15 fluorescence reading.

3. A low quantum yield of merocyanine form B of suggested photochromic spiropyrans.

For the above reasons, the 3D optical memory devices proposed in US Patent 5,268,862 are unsuitable for CD ROM type multilayer disks as well.

20 The use of organic dyes in optic WORM disks is known D.J. Gravesteijn, J. van der Veen, *Philips Tech. Rev.*, 41 (1983/1984), 325; J.E. Kuder, *J. Imag. Technol.*, 12 (1986), 140; J.E. Kuder, *J. Imag. Sci.*, 32 (1988), 51.

The most frequently used to produce WORM disks active layers are cyanine dyes in JP 08-108,630 (April 30, 1996); JP 07-186,530 (July 25, 1995); JP 06-336,086 (December 6, 1994); JP 06-227,138 (August 16, 1994), phthalocyanines Brit. UK Pat. Appl. GB 2,290,489 (January 3, 1996); JP 07-166,082 (June 27, 1995); Ger. Offen. DE 4,310,917 (October 7, 1993) and porphyrins JP 08-127,174 (May 21, 1996); JP 07-304,257 (November 21, 1995) herein incorporated by reference.

The majority of dyes belonging to these classes exhibit satisfactory fluorescence capacity in polymer matrices provided that true solutions have been formed, i.e. dyes are present in the polymer in a molecularly dispersed state.

10 In existing WORM disk technology, dyes are usually applied to a grooved substrate by spin coating or another method, e.g. vacuum evaporation, in the form of polycrystalline or amorphous opaque thin films having a thickness of about 10 nm. For this reason, and due to the fact that the laser wavelength being used for reading by the reflection coefficient variation method may not coincide with the dye absorption maximum, the dye concentration of the active layer should be as high as possible. In such layers the dyes used do not fluoresce. In 15 some cases, to obtain dye layers for WORM disks, polymer binders are used, M.S. Gupta, "Laser Recording on an Overcoated Organic Dye-Binder Medium", *Applied Optics*, 23 (22), Nov. 15, 1984; K.Y. Law *et al.*, "Ablative Optical Recording Using Organic Dye-in-Polymer Films", *Appl. Phys. Lett.*, 36 (11), Jun. 1, 1980; US Pat. 5,348,841 (September 20, 1994); JP 20 07-126,559 (May 16, 1995). In dye-in-polymer films of WORM disks, dyes are only partially dissolved in the polymer matrix, the major part of the dyes staying in the form of aggregates and solid particles. This sharply reduces their fluorescence capacity.

Therefore, dye layers, both with and without a polymer binder, used in WORM disks with the reading based on the variation of reflection coefficient, cannot be used in optical CD-ROM type memory disks with a fluorescence reading.

5 SUMMARY OF THE INVENTION

It is an object of the invention to provide a fluorescence-based reading method that has a number of advantages over methods based on the variation of reflection coefficient, even in the case of single-layer disk.

It is another object of the invention to reduce the precision requirements to pit
10 production as compared to existing CD-ROM's. For example, changing the pit size by 100 nm does not hinder reading from the fluorescence disk, while resulting in the complete disappearance of the reflection disk signal.

It is a further object of the invention to provide fluorescence disk insensitivity to disk plane tilt variations up to 1° , which is absolutely inadmissible for the reflection disk.

15 It is a still further object of the invention to provide a 3D optical memory carrier in the form of a multilayer disk.

To achieve these and other objects, the construction principle of a multilayer optical disk with fluorescence-based reading is as follows B. Glushko, US Provisional Patent Application No. 25457, 8/05/97 herein incorporated by reference. Single-layer optical disks
20 with pit-filling fluorescent material as information carrier are sequentially superimposed on one another so that a multilayer system is formed, where active layers consisting of fluorescing pits 0.5 to 1 μm deep alternating with inactive separation layers 20 to 50 μm thick, the latter being transparent for both the excitation laser light and the fluorescence light.

To produce a multilayer optical disk with fluorescence-based reading, a fluorescent composition meeting a number of specific requirements is used. The most important of these requirements are as follows:

- 5 1. The absorption bandwidth of the fluorescent compound should coincide with the emission wavelength of a laser used for reading.
2. The material should have the maximum possible quantum yield of fluorescence which will not decrease in long-term storage and operation.
3. To avoid over-absorption of fluorescence light, the overlay of the absorption and fluorescence bands should not be too large.
- 10 4. The fluorescent composition should not scatter the excitation laser emission and fluorescent light passing through it.
5. The fluorescent dye should be readily compatible with a matrix, forming a true solution of the needed concentration in the matrix, and should not migrate from it.
6. The fluorescent composition should penetrate the pits easily and not color space
15 among the pits.
7. The solution used for filling pits must not interact with a pit-containing substrate and change the geometric parameters of the pits.
8. The refraction index of the fluorescent composition must be close to that of a pit-containing substrate.
- 20 9. When storing and using a multilayer disk with pits that contain fluorescent composition, the properties of the disk must not change.

Still another object of the present invention is to develop a fluorescent composition exhibiting physical and physicochemical properties needed for use in CD-ROM type optical disks, including those intended for a 3D optical memory with fluorescence reading, where data carriers represent pits filled with fluorescent composition.

5 This fluorescent composition consisting of fluorescent dye, film-forming polymer, organic solvent, plastifier and (if necessary) surfactant and light stabilizer provides forming active layers of CD-ROM's with fluorescence reading, free from the drawbacks of prior art optical disks with active layers based on polymer films containing organic dyes.

This object is achieved by devising a composition including:

- 10 – A fluorescent dye whose absorption band coincides with the wavelength of the laser emission used for reading, this dye having a high quantum yield of fluorescence, forming a true solution with a polymer matrix and not migrating from the matrix;
- 15 – A film-forming polymer which exhibits a high transparency and does not scatter the laser emission and fluorescent light passing through the active layer, penetrates the substrate pits well and can easily be removed from the substrate;
- An organic solvent that provides good solubility of the fluorescent composition components, wets the pit-containing substrate surface, does not interact with substrate material and does not produce deformation of pits;
- 20 – A plastisizer which increases the elasticity of composition and helping its penetration into the pits.

Also, if necessary, the composition may be completed with surfactants that reduce the surface tension of the composition and thus improve substrate surface wetting and penetration of the solution into the pits; and with light-stabilizers, contributing to the preservation of

optical and spectral luminescence properties of the fluorescent composition in the storage and use of optical disks.

After being applied to the substrate and dried, the fluorescent composition has a refractive index close to that of substrate.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Various preferred embodiments of the present invention will now be set forth in detail with reference to the drawings, in which:

Fig. 1 shows a cross-sectional view of a portion of an optical disk according to a preferred embodiment of the present invention during an intermediate stage in its formation;

10 and

Fig. 2 shows a cross-sectional view of a portion of the completed optical disk.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The CD-ROM multilayer optical disk of the invention is shown in Fig. 1 wherein a
15 substrate 1 having pits 3 is filled with a fluorescent composition 5 having the properties described herein. The multilayered structure can be formed by either glueing at least one other layer of substrate 9 to the substrate 1 by the adhesive layer 7. The adhesive is preferably a UV or photo cured adhesive that is cured with light ray 11. Alternatively, layers of substrate 9 can be cast or coated onto substrate 1 as long as the casting or coating process
20 does not disturb the previously formed layer with pits filled with the fluorescent composition. A multi layered optical disk is shown in Fig. 2 the disk 13 as shown has ten layers.

The fluorescent composition used for the manufacture of CD-ROM type optical disks, including those intended for the 3D optical memory with fluorescence reading, where pits filled with this fluorescent composition play the role of data carriers, is produced as follows:

First, solutions of fluorescent dye, film-forming polymer, plasticizer, surfactant and
5 light-stabilizer in appropriate solvents are prepared.

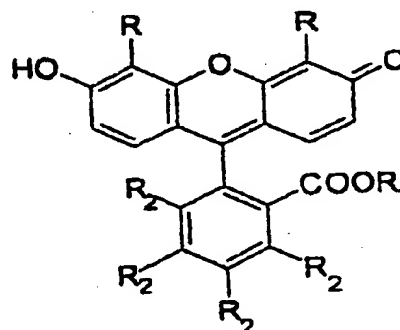
Then these solutions are mixed together, homogenized and filtered. After deaeration, a transparent solution is obtained with the following concentration values: film-forming polymer 0.2 – 5.0 wt. %, fluorescent dye 0.001 – 0.1 mole/kg, plasticizer 1.0 – 50 wt. % w.r.t. the polymer, surfactant 0.01 – 2.0 wt. % w.r.t. the polymer, and light-stabilizer 0.1 – 2.0 wt.
10 % w.r.t. the polymer. The fluorescent composition solution is applied by spin coating, roller coating, or dip coating to the surface of substrate representing a pitted disk made from polycarbonate or PMMA.

The coating is applied so that the pits are filled with the composition, while the substrate surface among the pits remains uncolored and does not fluoresce. When necessary,
15 the remaining fluorescent composition is removed from the substrate surface by rinsing with a solvent or mechanically.

To produce a multilayer disk intended for the 3D optical memory with fluorescence reading, single-layer disks whose pits are filled with fluorescent composition are sequentially glued to one another in such a way that the active layers consisting of fluorescent pits 0.1 –
20 1.0 μm deep (preferably, 0.3 – 0.5 μm deep) alternate with inactive separation layers 20 to 50 μm thick, these layers being transparent for the laser excitation and fluorescent light wavelengths.

The following compounds are used for fluorescent dyes:

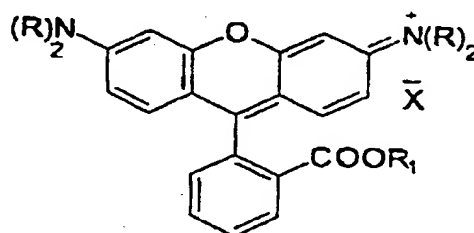
1. Xanthene dyes of the eosine group, including fluorescein, eosine, erythrosine, dichlorofluorescein of the general structure I



I

where R stands for H, Cl, Br, or I; R₁ stands for H, Na, Alk; and R₂ stands for H, Cl.

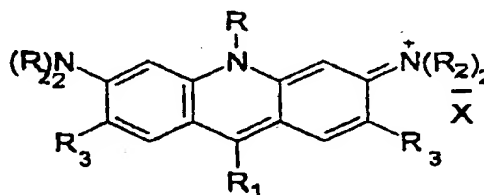
2. Xanthene dyes of the rhodamine group, including rhodamine B, 3B, C, G, 6G, 101, of the general structure II



II

- 15 where R stands for H, CH₃, C₂H₅, CH₂COOH, C₂H₄OH; R₁ stands for H, Na, CH₃, C₂H₅, Ar; and X is an anion selected from Cl⁻, Br⁻, I⁻, F⁻, HCO₂⁻, CH₃CO₂⁻, ClO₄⁻.

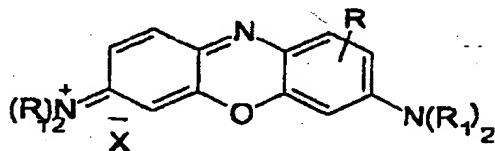
3. Acridine dyes of the general structure III



III

where R stands for H, CH₃, C₂H₅; R₁ stands for H, C₆H₅; R₂ stands for H, Alkyl; R₃ stands for H, CH₃; and X is an anion selected from F, Cl, Br, I, HCOO, CH₃CHOHCOO, ClO₄, etc..

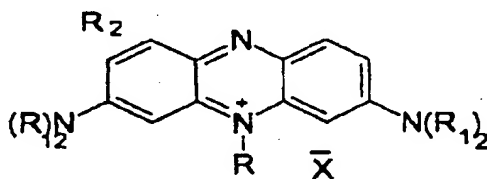
4. Oxazine dyes of the general structure IV



IV

where R stands for H, CH₃, and benzo-group; R₁ stands for H, CH₃, C₂H₅; and X is an anion selected from Cl, Br, I, HCO₂, CH₃CHOHCO₂, ClO₄, etc..

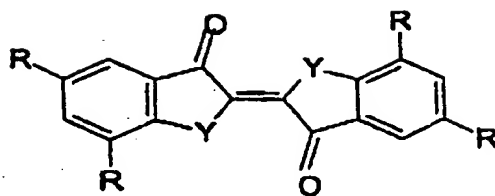
5. Azine dyes of the general structure V



V

where R stands for phenyl, naphthyl; R₁ stands for H, alkyl, phenyl; R₂ stands for H, benzo-group; R₃ stands for H, SO₃H; and X is an anion.

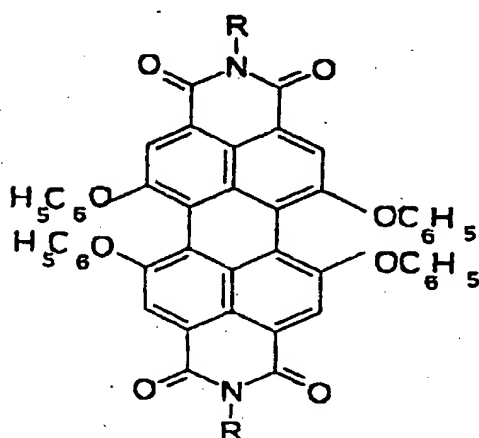
6. Indigoide dyes of the general structure VI



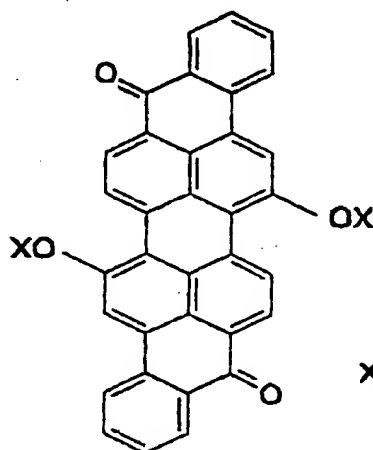
VI

where Y stands for S, NH; R stands for H, Cl, Br, I, Oalkyl, Oaryl etc.

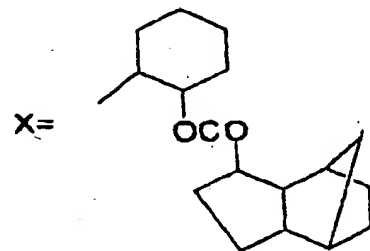
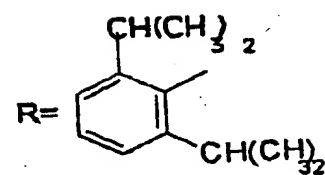
5 7. Perylene and violanthrone dyes containing structures VII and VIII



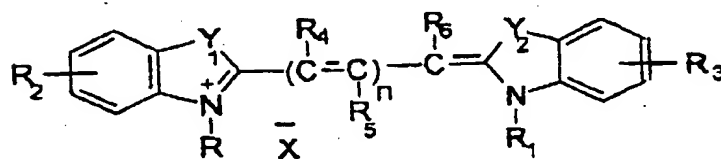
VII



VIII



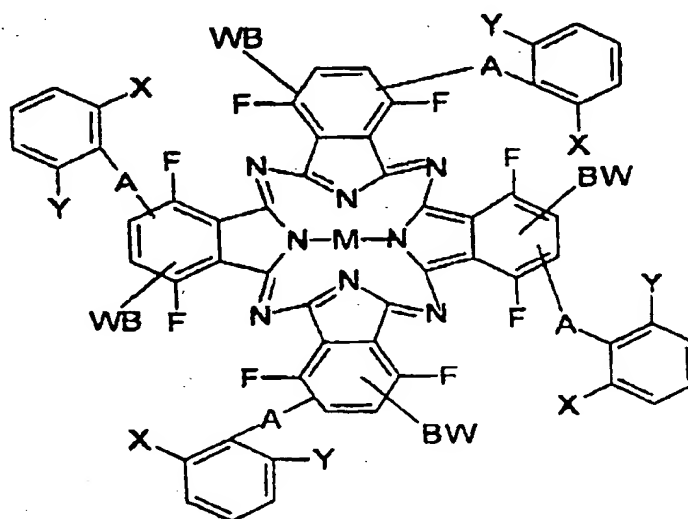
8. Cyanine dyes of the general structure IX



IX

where $Y_1 = Y_2$, $Y_1 = Y_2$, Y_1 and Y_2 stand for O, S, N-Alk, N-Ar, $C(CH_3)_2$; R and R_1 stand for Alk, Ar; $R_2 - R_3$ are various substituents, including those forming cyclic groups; X is an anion; $n = 1 - 3$

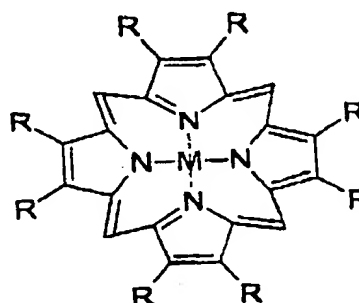
9. Phthalocyanine dyes containing the structure X



X

where A, B stand for O, S; W stands for Alk; X stands for COOR; Y stands for Alk, AlkO, COOR; M stands for 2H, metal, metal oxide, metal halide.

10. Porphyrins of the structure XI



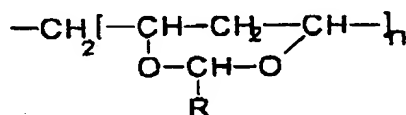
XI

where R stands for Alk, Ar, C₆F₅, C₆H₁₁; M stands for 2H, Mg, AlCl₃, Fe⁺³ etc..

When producing fluorescent composition, film-forming polymers exhibiting high transparency, easily penetrating pits and easily removable from the substrate surface are used.

They include the following high-molecular compounds:

- 5 1. Polyvinylacetals, carbochain polymers of the general structure XII

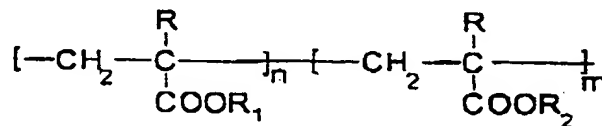


10

XII

where R stands for H, CH₃, C₂H₅, C₃H₇, C₄H₉. This group includes polyvinylbutyral containing 55 to 75 mol. % of butyral group and having a glass transition temperature of 55°C; polyvinylformal with an acetalization degree of 75 to 85 mol. %; and polyvinylethylal. These polymers may be used together with phenol-formaldehyde resins.

- 15 2. Acrylic resins - polymers of acrylic and metacrylic esters and copolymers of alkylacrylates with acrylic or metacrylic acid of the general structure XIII,



20

XIII

where R stands for H, CH₃; R₁ and R₂ stand for Alk; R₁ stands for Alk; R₂ stands for H; and n/m = 1 to 4. This group includes polymethylmetacrylate, polybutylmetacrylate, and methylmetacrylate- or butylmetacrylate-metacrylic acid copolymers.

3. Cellulose ethers and esters of the general structure [C₆H₇O₂(OR)₃]_n (XIV) and
5 [C₆H₇O₂(OCOR)₃]_n (XV), respectively, including ethyl cellulose with $\gamma = 230 - 260$ (where γ is the number of substituted hydroxyl groups per 100 glycoside residues of the cellulose macromolecule), cellulose acetobutyrate, and cellulose nitrate (with a nitrogen content of 9 - 11 %).

Apart from this, phenol-formaldehyde resins (resols and novolacs), melamine-
10 formaldehyde resins, urea-formaldehyde resins, and polyvinylacetate may be used as film-forming polymers for fluorescent compositions.

Solvents being used for fluorescent compositions wet the substrate surface well, help composition penetration into the pits, but do not interact with the substrate material and produce no pit deformation. When polycarbonate disks are used, only dioxane and aliphatic
15 alcohols, methanol, ethanol, propanol, isopropanol, isobutanol, pentanol and their mixtures may be used as solvents.

Film-forming polymers proposed in the present invention exhibit various ranges of a highly elastic state and, therefore, provide different plasticity of coatings. An inadequate plasticity of the polymer hinders the penetration of the fluorescent composition in small pits
20 of size 0.1 - 1.0 μm . In such cases, plastifiers are used. As plastifiers allow the decrease of the flow point and glass transition temperature, as well as the elasticity modulus of fluorescent composition, proposed are phthalic esters (including dibutyl phthalate and dioctyl phthalate), sebacic esters (including dibutyl sebacate and di-(2-ethyl-hexyl) sebacate), and

phosphate esters (including tributyl phosphate and tricresyl phosphate). These plastifiers form true solutions in fluorescent compositions and produce no blurring when storing or using disks.

To improve the substrate and pit surface wettability with the fluorescent composition solution, as well as the solution spreadability, surfactants reducing the surface tension at the solid - liquid interface are used. As surfactants, non-ionogenic compounds like Tritons X and FC-430 and FC-431 Fluorosurfactants produced by the 3M Company can be used.

As light-stabilizers, HALS (Hindered Amine Light Stabilizers), in particular, Tinuvin 292, 144, 622, and 770 are used.

Multilayer optical disks are manufactured using adhesives which provide a good shrinkage-free adhesion of the surfaces being connected, produce no adverse effect on the properties of fluorescing pits and signal-to-noise ratio, transparent for laser excitation and fluorescence light. These requirements are met by UV-light cured optical adhesives, preferably P-92, UV-71, UV-69, UV-74, J-91, VTC-2, SK-9. from Summers Laboratories, Collegeville, PA.

Example 1.

To produce a fluorescent composition, the following ethyl alcohol solutions are prepared:

Compound	Concentration, g/l
Polyvinylbutiral	50
Oxazine 1	8.5
Diocetyl phtalate	30

Triton X-45	1.0
Tinuvin 292	10

These alcohol solutions are mixed in proportions providing the following concentrations of components:

Compound	Concentration
Polyvinylbutiral (PVB)	10 g/l
Oxazine 1	1.3 wt. % w.r.t. PVB
Diocetyl phthalate	20 wt. % w.r.t. PVB
Triton X-45	0.03 wt. % w.r.t. PVB
Tinuvin 292	0.5 wt. % w.r.t. PVB

The composition solution is filtered, allowed to stand at 40°C for aeration and applied by spinning to a pitted polycarbonate disk at 60°C. Having been exposed for 20 minutes, the
5 fluorescent composition layer is treated with ethyl alcohol for 20 seconds while remaining on the spinner. The produced fluorescence disk has the data pit background noise contrast ratio γ = 6, as compared to γ = 1.3 for usual disks with reflection-based reading. The fluorescent composition has an absorption maximum at 645 nm and a fluorescence maximum at 680 nm and is therefore suitable for fluorescence reading by diode laser with an emission wavelength
10 of 640 nm.

Example 2

A composition similar to that of Example 1, except that Nile blue (perchlorate) is used as a fluorescing dye. A 6.3-g/l solution in ethyl alcohol is taken in proportion giving a concentration of 1.0 wt. % w.r.t. PVB. The produced fluorescence disk has a contrast ratio γ =

5. The fluorescent composition has an absorption maximum at 630 nm and a fluorescence maximum at 665 nm.

Example 3

A composition similar to that of Example 1, except that cyanine dye HITC (iodide) is used as a fluorescing dye. A 5.1-g/l solution in ethyl alcohol is taken in proportion giving a concentration of 0.8 wt. % w.r.t. PVB. The produced fluorescence disk has a contrast ratio $\gamma =$
7. The fluorescent composition has an absorption maximum at 640 nm and a fluorescence maximum at 680 nm.

Example 4

10 A composition similar to that of Example 1, except that cyanine dye HITC (perchlorate) is used as a fluorescing dye. A 5.3-g/l solution in ethyl alcohol is taken in proportion giving a concentration of 0.7 wt. % w.r.t. PVB. The produced fluorescence disk has a contrast ratio $\gamma =$
7. The fluorescent composition has an absorption maximum at 755 nm and a fluorescence maximum at 800 nm and is suitable for fluorescence reading by diode laser with an emission
15 wavelength of 780 nm.

Example 5

Compositions similar to those in Examples 1 - 4. Ethanol-2-propanol-isobutanol mixture (7:1.5:1.5) is used as a solvent, methacrylate copolymer resin 2550 (Elvacite acrylic resins, DuPont) with a concentration of 7.5 g/l is used as a film-forming polymer, and dioctyl
20 phtalate with a concentration of 40 wt. % w.r.t. copolymer 2550 is used as a plastifier. In these fluorescent compositions, Triton X-45 and Tinuvin 292 are not used. Using oxazine 1 as a fluorescent dye gives $\gamma = 5$, nile blue gives $\gamma = 4$, HIDC (iodide) gives $\gamma = 5$, and HITC (perchlorate) gives $\gamma = 5$.

Example 6

Compositions similar to those in Example 5, except that 5-g/l solution of polyvinylacetate is used as a film-forming polymer. Using oxazine 1 as a fluorescent dye gives $\gamma = 9$, Nile blue gives $\gamma = 8$, HIDC (iodide) gives $\gamma = 10$, and HITC (perchlorate) gives $\gamma = 9$.

Example 7

To produce a multilayer optical disk of CD ROM type with fluorescence reading, as shown in Fig. 1, a single-layer disk 1 of 120 μm thickness with pits 3 filled with the fluorescent composition 5 prepared according to Example 1, 2, 3, 4, 5 or 6 is covered with a layer 7 of UV-69 adhesive, and a similar fluorescence disk 9 with a polycarbonate substrate of 30 μm thickness is glued thereto. The adhesive is cured with UV light 11. In just the same way, as shown in Fig. 2, another eight disks 9 similar to the second one are sequentially glued. This process gives a 10-layer fluorescence disk 13 with the bottom layer contrast ratio at least .5.

While various embodiments have been set forth above, those skilled in the art who have reviewed this disclosure will readily appreciate that other embodiments can be realized within the scope of the present invention. For example, disclosures of the number and thicknesses of layers, the concentrations of various materials, the choice of a substrate material, and the like should be understood as illustrative rather than limiting. Therefore, the present invention should be construed as limited only by the appended claims.

WHAT IS CLAIMED IS:

1. A fluorescent composition for manufacture of a single-layer optical disk of CD-ROM type with fluorescence reading, the fluorescent composition comprising:

at least one fluorescent dye;

5 at least one film-forming polymer;

a plastisizer; and

an organic solvent

2. The fluorescent composition of claim 1, further comprising:

a surfactant; and

10 a light stabilizer.

3. The fluorescent composition of claim 1, wherein the fluorescent dye is in a concentration of 0.001 – 0.1 mole per kg of the film-forming polymer.

4. The fluorescent composition of claim 3, wherein the fluorescent dye is selected from the group consisting of xanthene dyes of the eosine group, xanthene dyes of the rhodamine group, acridine dyes, oxazine dyes, azine dyes, indigoide dyes, perylene dyes, violanthrone dyes, cyanine dyes, phthalocyanine dyes, and porphyrins.

5. The fluorescent composition of claim 1, wherein the film-forming polymer is in a concentration of 2.0–50.0 g/l .

6. The fluorescent composition of claim 5, wherein the film-forming polymer is selected from the group consisting of polyvinylacetals, acrylic resins, cellulose ethers, cellulose esters, phenol-formaldehyde resins, melamine-formaldehyde resins, urea-formaldehyde resins, and polyvinylacetate.

7. The fluorescent composition of claim 1, wherein the plasticizer is in a concentration of 1.0 – 50.0 wt. % with respect to film-forming polymer.
8. The fluorescent composition of claim 7, wherein the plasticizer is selected from the group consisting of phthalic esters, sebacic esters, and phosphate esters.
- 5 9. The fluorescent composition of claim 1, wherein the surfactant comprises a non-ionogenic compound in a concentration of 0.01 – 2.0 wt. % with respect to film-forming polymer.
- 10 10. The fluorescent composition of claim 2, wherein the light stabilizer comprises HALS (Hindered Amine Light Stabilizer) in a concentration of 0.1 – 2.0 wt. % with respect to the film-forming polymer.
11. The fluorescent composition of claim 1, wherein the organic solvent is selected from the group consisting of methanol, ethanol, isopropanol, pentanol and mixtures thereof.
12. A method of manufacturing a CD-ROM type optical disk, the method comprising:
- 15 providing a substrate which is formed as a disk which has a surface and is covered with pits in the surface; and
- applying a fluorescent composition by spin coating, roller coating, or dip coating to the surface of the substrate so as to fill the pits with the fluorescent composition, while the surface outside the pits remains free of the fluorescent composition and does not fluoresce.
13. The method of claim 12, wherein the pits are 0.1-1.0 micrometers deep.
- 20 14. The method of claim 13, wherein the pits are 0.3-0.5 micrometers deep.
15. A method of manufacturing a multilayer CD-ROM type optical disk the method comprising:

forming a plurality of single-layer disks, each of the single-layer disks being formed by
(a) providing a substrate which is formed as a disk which has a surface and is covered with
pits in the surface and (b) applying a fluorescent composition by spin coating, roller coating,
or dip coating to the surface of the substrate so as to fill the pits with the fluorescent
5 composition, while the surface outside the pits remains free of the fluorescent composition
and does not fluoresce; and

sequentially affixing the plurality of single-layer disks onto one another.

16. The method of claim 15, wherein the plurality of single-layer disks are affixed onto
one another by gluing.

10 17. The method of claim 16, wherein the plurality of single-layer disks are formed and
glued to one another such that the multi-layer disk comprises active layers alternating with
inactive layers.

18. The method of claim 17, wherein the inactive layers are 20-50 micrometers thick.

15 19. The method of claim 18, wherein the inactive layers are transparent to a wavelength
of light used to cause the fluorescent composition to fluoresce and to a wavelength of light
given off by the fluorescent composition when the fluorescent composition fluoresces.

20. The method of claim 16, wherein the single-layer disks are glued onto one another
with a UV-light cured optical adhesive.

20 21. The method of claim 20, wherein the UV-cured optical adhesive is selected from
the group consisting of P-92, UV-69, UV-71, UV-74, J-91, VTC-2, and SK-9 adhesives.

22. A fluorescent CD-ROM optical disk comprising at least one substrate, said substrate containing pits wherein said pits are filled or coated with a fluorescent composition, said fluorescent composition comprising a fluorescent dye, a film-forming polymer and a plasticizer.
23. The optical disk of claim 22 wherein the fluorescent composition further comprises a surfactant and a light stabilizer.
24. The optical disk of claim 23, wherein the fluorescent dye of the fluorescent composition is in a concentration of about 0.001 - 0.1 mole per kg of the film forming polymer.
25. The optical disk of claim 22 wherein the film forming polymer is in a concentration of about 2.0 - 50.0 g/l.
26. The CD-ROM optical disk of claim 25 wherein the film forming polymer is selected from the group consisting of polyvinylacetals, acrylic resins, cellulose ethers, cellulose esters, phenol-formaldehyde resins, melamine-formaldehyde resins, urea-formaldehyde resins, and polyvinylacetate.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
AS IPEA FOR THE PATENT COOPERATION TREATY

In re application of: OMD DEVICES LLC *et al.*
International Appln. No.: PCT/US98/23625
International Filing Date: 06 November 1998
Entitled: FLUORESCENT COMPOSITION . . . MEMORY DISKS

Assistant Commissioner for Patents
Box PCT
Washington, D.C. 20231

Attn: C. Melissa Koslow,
IPEA/US Authorized Officer

Dear Sir/Madame:

**AMENDMENT AND ARGUMENT UNDER PCT ARTICLE 34
IN RESPONSE TO WRITTEN OPINION**

In accordance with PCT Article 34 (2)(d) and Rules 66.3, 66.5 and 66.8 in the above-referenced application, in response to the Written Opinion mailed 14 July 1999, applicants request that the enclosed replacement description and claims be substituted for the pages of these elements of the application as originally filed. No new matter is introduced.

Pursuant to the PCT Administrative Instructions, § 205(b), the following is a summary of the claims in the application:

- (i) claims 1, 2, 6, 8, 13, 14, 16-21 and 23-26 are unchanged and
- (ii) claims 3-5, 7, 9-12, 15 and 22 replace the claims as filed of the same numbers.

Remarks

The Written Opinion of 14 July 1999 has been carefully studied. The Examiner is thanked for the indication of novelty and inventive step in claims 1-11 and 15-21.

The Examiner found lack of an inventive step under PCT Article 33(3) in claims 12-14 and 22-26 over *Chikuma*. These findings are respectfully traversed for the following reasons.

In arguing lack of an inventive step, the Examiner relies on unsupported assertions about which coating methods *Chikuma* would have suggested to a person having ordinary skill in the art and about the use of film-forming resins and plasticizers in the prior art. In response, it is respectfully submitted that such assertions should be either backed up by additional prior art or withdrawn.

The invention as defined in the claims at issue relates to a method of manufacturing an optical disk of the CD-ROM type. The method includes a step of providing a substrate which is formed as a disk which has a surface and is covered with pits in the surface; and a step of applying a fluorescent composition by spin coating, roller coating, or dip coating to the surface of the substrate so as to fill the pits with the fluorescent composition, while the surface outside the pits remains free of the fluorescent composition and does not fluoresce. Thus, the fluorescent composition is contained in the pits, but not in the surface outside the pits, so that the fluorescent composition is isolated to the pits.

The present claimed invention offers an advantage over known techniques for manufacturing such a disk in that the processes of the prior art are complicated, time-consuming and expensive. The process of the present invention is less expensive and is suitable for mass production.

By way of comparison, *Chikuma* teaches an optical recording medium having a transparent substrate with a patterned surface, the pattern being in the form of spaced-apart pits, and a fluorescent material located in the pits. However, *Chikuma* fails to disclose in detail the manner in which the recording medium is manufactured. All that is said is that the recesses or pits are produced with a stamper (master disk) to the substrate (col. 2, lines 50-54) and that the recesses are individually filled with a light-emitting filler material (col. 2, lines 36-38).

The present claimed invention, through the use of the method steps of claims 12-14 or the compositions of claims 22-26, avoids the need to fill each recess individually. Thus, optical disks can be manufactured more efficiently and inexpensively. A person having ordinary skill in the art would not have been taught that such an improvement was possible

and therefore would not have been motivated to attempt it. As a result, the present claimed invention offers an inventive improvement over *Chikuma*.

The Examiner is respectfully requested in the International Preliminary Examination Report (IPER) to withdraw the findings of lack of inventive step made in the Written Opinion and to issue a totally positive IPER for the reasons stated.

Respectfully submitted,

By: 

Herbert Cohen

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14 September 1999

Encl.: Amendment under Article 34

HC/DJE/jw

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/23625

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : C09K 11/06; G11B 3/70, 7/24

US CL : Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 252/301.35, 301.34; 427/157; 396/288, 283, 275.4, 101; 420/270.14, 270.15, 270.18, 270.19, 270.2, 270.21

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,205,963 A (BRITO et al) 27 April 1993 (27-04-93), whole doc.	1-11
X	US 4,927,681 A (CHIKUMA) 22 May 1990 (22-05-90), col. 2, line 25-col. 5, line 16.	12
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Y		13-26

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*A* document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

11 JANUARY 1999

Date of mailing of the international search report

01 FEB 1999

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
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Washington, D.C. 20231

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US98/23625

A. CLASSIFICATION OF SUBJECT MATTER:

US CL :

252/301.35, 301.34; 427/157; 396/288, 283, 275.4, 101; 420/270.14, 270.15, 270.18, 270.19, 270.2, 270.21